2017-B

B2-1

Paの単位は $N/m^2 = \frac{kg\cdot m/s^2}{m^2} = kg/m\cdot s^2$

よって $[\Delta p] = [ML^{-1}T^{-2}]$

L: $-2 = \alpha_1 - \alpha_2 - 3\alpha_3 + \alpha_4$

M: $1 = \alpha_2 + \alpha_3$ $\quad \alpha_3 = 1 - \alpha_2$

T: $-2 = -\alpha_2 - \alpha_4$ $\quad \alpha_4 = 2 - \alpha_2$

よって $\alpha_1 = -2 + \alpha_2 + 3\alpha_2 - \alpha_4$

$= -1 - \alpha_2$

まとめると

$$\frac{\Delta p}{H} = k\left(\frac{\rho v d}{\mu}\right)^{-\alpha_2} \times \frac{\rho v^2}{d}$$

$\frac{\rho v d}{\mu}$ ↓ Reynolds数

$$\frac{\Delta p}{H} \times \frac{d}{\rho v^2} = k\left(\frac{\rho v d}{\mu}\right)^{-\alpha_2}$$

$\ln$(左辺) $= \ln k + \ln Re^{-\alpha_2} = \ln k - \alpha_2 \ln Re$

$Re = 10^0 = 1$ でグラフより $k = 8\times10^{-2}$

グラフの傾きはパッと見-1

よって $-\alpha_2 = -1$

$\alpha_2 = 1$